AMENDMENTS TO THE CLAIMS

LISTING OF CLAIMS:

1.   (Currently Amended) An absolute position rotary encoding apparatus comprising:

a disk having a first code track and a second code track formed on said disk;

a light source for illuminating said code tracks;

a first area array sensor, comprising a pixel matrix having a plurality of rows, configured to receive the light illuminating said code tracks for forming an imaged pattern of a portion of said first and second code tracks simultaneously,

wherein the encoding apparatus ~~being to~~includes:

a detector adapted to –read a first detector line corresponding to a row in the pixel matrix comprising the imaged pattern of the first code ~~track;~~track and

~~read~~ a second detector line corresponding to a row in the pixel matrix comprising the imaged pattern of the second code track; and

a Field Programmable Gate Array (FPGA)/processor adapted to

compensate for fluctuations in the code tracks, resulting from the disk being inaccurately mounted, by dynamically shifting at least one of said detector lines on the ~~first~~area array sensor being read, corresponding to a radial shift along a code track on said disk, such that a period length of the imaged pattern along said at least one detector line remains constant; and

numerically calculate an absolute position based on a light distribution of the imaged patterns of the incremental and absolute ~~imaged~~code tracks from the disk.

2.   (Previously Presented) An encoding apparatus according to claim 1, wherein the disk is an optical disk suitable for use in a rotary encoder and the first code track represents the incremental track and the second code track represents the absolute track.

3.   (Previously Presented) An encoding apparatus according to claim 1, wherein said light source is a photoemitter such as an LED, laser diode, or incandescent light source.

4.   (Previously Presented) An encoding apparatus according to claim 1, wherein the first area array sensor is constructed of either CCD or CMOS photodiode technology.

5.   (Previously Presented) An encoding apparatus according to claim 1, wherein said light source and said first area array sensor are proximally located on a first side of the disk and a mirror located on a second side, whereby the emitted light is reflected by the mirror through the disk to illuminate the code tracks for reception by the first area array sensor.

6.   (Previously Presented) An encoding apparatus according to claim 1, further including a Field Programmable Gate Array (FPGA) logic circuit for numerically calculating phase intensity distribution, spatial frequency and the phase angle of the imaged pattern of the code tracks.

7.   (Previously Presented) An encoding apparatus according to claim 2, further comprising a second area array sensor, wherein the first area array sensor and the second area array sensor are positioned 180 degrees apart with respect to the optical disk, such that the incremental and absolute code tracks are read at two different locations resulting in two different angular positions, and wherein the absolute position is based on the mean of the angular positions.

8.   (Original) An encoding apparatus according to claim 2, wherein the incremental track is comprised of a plurality of equally spaced and radially distributed markings near the outer edge of the disk, and wherein the absolute track is comprised of markings that form a series of coded lines that include broad and narrow lines radially distributed inside the incremental track such that the broad lines divide the track into equally sized sections and within each section are two narrow data lines that carry information about absolute position.

9.-10. (Cancelled)

11.   (Currently Amended) An encoding apparatus according to claim 7, further comprising third and fourth area array sensors positioned 90 degrees apart with respect to the optical disk, such that the incremental and absolute code tracks are read at four different locations.

12.   (Currently Amended) A Total Station theodolite apparatus used for topographic surveying and mapping includes an optical encoder for measuring angular position in the vertical plane and the horizontal plane and cooperates with a servo-mechanism for automatically tracking a target, said encoder comprising:

an optical disk having an incremental code track and an absolute code track formed thereon;

a photoemitter light source for illuminating said code tracks;

a first area array sensor, comprising a pixel matrix having a plurality of rows, configured to receive the light illuminating said code tracks for forming an imaged pattern of a portion of said incremental and absolute code tracks simultaneously,

wherein the encoder ~~being configured to~~includes:

a detector adapted to read a first detector line corresponding to a row in the pixel matrix comprising

imaged pattern of the ~~incremental~~first code ~~track;~~track

~~read~~and a second detector line corresponding to a row in the pixel matrix comprising the imaged pattern of the ~~absolute~~second code track; and

a Field Programmable Gate Array (FPGA)/processor adapted to

compensate for fluctuations in the code tracks, resulting from the disk being inaccurately mounted, by dynamically shifting at least one of said detector lines on the area array sensor being read, corresponding to a radial shift along a code track on said disk, such that a period length of the imaged pattern along said at least one detector line remains constant; and

numerically calculate an absolute position based on a light distribution of the imaged ~~code~~patterns of the incremental and absolute code tracks from the disk; and

calculate topographic data and tracking information about the target.

13. (Previously Presented) A Total Station apparatus according to claim 12, wherein the optical disk is opaque with transparent markings defining the incremental and absolute code or is a transparent disk with opaque markings defining the incremental and absolute code tracks.

14. (Previously Presented) A Total Station apparatus according to claim 12, wherein the photoemitter light source is an LED, laser diode, or incandescent light source and the first area array sensor is an Interline Transfer (ILT) CCD area array sensor.

15. (Previously Presented) A Total Station apparatus according to claim 12, wherein the encoder further includes a Field Programmable Gate Array (FPGA) logic circuit for numerically calculating phase intensity distribution, the spatial frequency and the phase angle of the imaged pattern of the code tracks.

16. (Previously Presented) A Total Station apparatus according to claim 12, further comprising a second area array sensor, wherein the first area array sensor and the second area array sensor are positioned 180 degrees apart with respect to the optical disk, such that the incremental and absolute code tracks are read at two different locations resulting in two different angular positions, and wherein the absolute position is based on the mean of the angular positions.

17. (Previously Presented) A Total Station apparatus according to claim 12, wherein the incremental track is comprised of a plurality of equally spaced and radially distributed markings near an outer edge of the disk, and wherein the absolute track is comprised of markings that form a series of coded lines that include broad and narrow lines radially distributed inside the incremental track such that the broad lines divide the track into equally sized sections and within each section are two narrow data lines that carry information about absolute position.

18.   (Previously Presented) A Total Station apparatus according to claim 12, further comprising a processor for calculating the topographic data and a controller for operating the automatic tracking servo-mechanism.

19.-20. (Cancelled)

21.   (Previously Presented) A method of calculating an absolute position with an optical rotary encoder device comprising:

illuminating with a light source an incremental code track and an absolute code track formed on a disk;

imaging a segment of the incremental and absolute code tracks onto a first CCD or CMOS area array sensor for forming an imaged pattern of the code tracks, said area array sensor comprising a pixel matrix having a plurality of rows;

reading a first detector line corresponding to a row in the pixel matrix comprising the imaged pattern of the incremental code track;

reading a second detector line corresponding to a row in the matrix comprising the imaged pattern of the absolute code track;

compensating for fluctuations in the code tracks, resulting from inaccurate mounting of the disk, by selecting suitable first and second detector lines such that a period length of the imaged pattern of the code tracks along the detector lines remains constant; and

calculating numerically the absolute position based on light distribution of the imaged patterns of the incremental and absolute code tracks.

22.   (Previously Presented) The method according to claim 21, wherein the incremental and absolute code tracks are imaged also onto a second CCD or CMOS area array sensor, where the first and second area array sensors are positioned 180 degrees apart with respect to the optical disk, such that the incremental and absolute code tracks are imaged at two different locations resulting in two different angular positions, and wherein the absolute position is based on the mean of the angular positions.

23.   (Previously Presented) The method according to claim 22, wherein said light source and said first and second area array sensors are proximally located on a first side of the disk and a mirror located on a second side, whereby emitted light is reflected by the mirror through the disk to illuminate the code tracks for reception by the first and second area array sensors.

24.   (Previously Presented) The method according to claim 21, wherein the compensating dynamically changes the detector line of the incremental track image when a pattern period changes due to spatial movement of the disk, so that the detector line is shifted in order for a period length of the imaged pattern along said detector line of the incremental track image to remain constant.

25.   (Previously Presented) The method according to claim 21, wherein the compensating includes altering a numerical value of the pattern period used in a Fourier phase algorithm to match spatial frequency of fluctuating tracks.

26.   (Original) The method according to claim 21, wherein at least a Field Programmable Gate Array (FPGA) performs at least a portion of the numerical calculations.

27.   (Previously Presented) The method according to claim 21, wherein the incremental and absolute code tracks are imaged also onto third and fourth CCD or CMOS area array sensors, where the first through fourth area array sensors are positioned 90 degrees apart with respect to the disk, such that the incremental and absolute code tracks are read at four different locations.